Hall Ticket Number:

Code No. : 12016 EM O2

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS) II-Semester Old Examinations, May/June-2018

Engineering Mechanics

(Civil, EEE & Mech. Engg.)

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Prove that product of Inertia is zero with respect to axes of symmetry.
2. Calculate the mass moment of inertia of a disc, having mass of 40 kg and radius 500 mm, about a diametrical axis.
3. A motor cycle at 15 km/hr per 2 hrs, 20 km/hr for 3 hrs and then finally 30 km/hr for 5 hrs. How fast must the motor cycle has to move in the last 5 hrs to attain an average speed of 30 km/hr?
4. A bomb is released from an airplane flying at a speed of 1000 kmph on a straight level course 2000 m above the ground. Find the time required for bomb to reach the ground, and the horizontal distance travelled by the bomb after its release.
5. Determine the force 'P' that will give the body in fig.1 an acc. of 0.2 m/sec2. The coefficient of kinetic friction is 0.20.

Fig. 1

6. Rotation of a flywheel is defined by the relation $\omega = 3\ t2\text{-}2t + 20$ whereω is the angular velocity and "t" is the time in sec. What is the acceleration of the flywheel at 3 sec.?
7. A block of mass 0.5 kg slides down on an incline of inclination 30◦ and distance 10 m. Find the work done by force of gravity.
8. Explain W-E method, as applied to fixed axis rotation.
9. A marble of mass 200 gm is dropped form a height of 12 cm on to a rough horizontal ground. What is the velocity of impact with the ground?
10. State the principle of conservation of linear momentum of a particle.

Part-B (5 × 10 = 50 Marks)

(All sub-questions carry equal marks)

11. a) Determine the P.I of the shaded area as shown in Fig. 2.

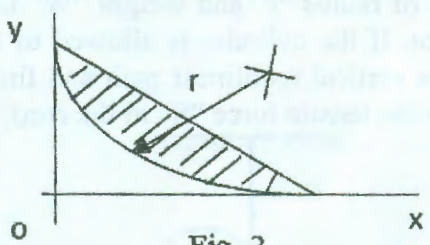

Fig. 2

b) Determine the mass moment of inertia of the right circular cone of mass 'm' base radius 'r', and height 'h', with respect to a geometric axis.

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12. a) A stuntman drives a motor cycle around a circular vertical wall of 30 m in diameter. The co-efficient of friction between tires and wall is 0.60. What is the minimum speed that will prevent his sliding down the wall? At what angle will the motor cycle be inclined to the horizontal? What is the effect of travelling at a greater speed?

b) A particle has an initial velocity of 60 m/s up to the right at a slope of 0.75. The component of acceleration are constant at a_x= -3.5 m/s^2 and a_y = -6m/s^2 Compute the radius of curvature at the start and at the top of the path.

13. a) The two bodies in the Fig. 3 shown below are separated by a spring. Their motion down the incline is resisted by a force P= 900N.The auto accelerates and decelerates at 2m/s^2, starting from rest at A and coming to a stop at B. Find the maximum speed in m/sec.

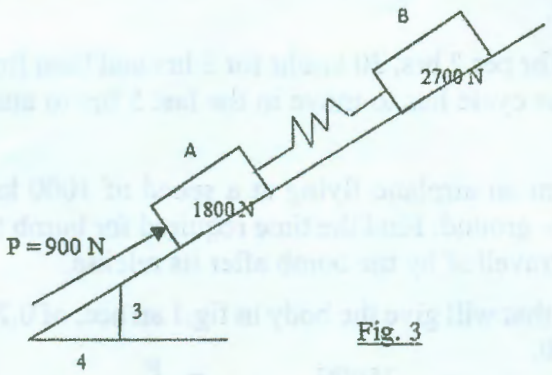

Fig. 3

b) An elevator cage of mine shaft weighing 8 kN, when empty, is lifted or lowered by means of a wire rope. Once a man weighing 600 N, entered it and lowered with uniform acceleration such that when a distance of 187.5 m was covered, the velocity of the cage was 25 m/sec. Determine the tension in the rope and the force exerted by the man on the floor of the cage.

14. a) By using work energy equation calculate the velocity and acceleration of block A and block B shown in Fig.4 after block A has moved 1.5m from rest. The coefficient of friction is 0.3 and the pulleys are frictionless and weightless. Also calculate the tension in the spring.

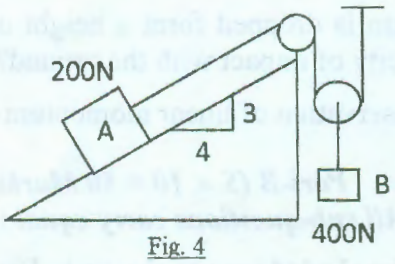

Fig. 4

b) A right circular cylinder of radius "r" and weight "W" is suspended by a cord that is wound around its surface. If the cylinder is allowed to fall, prove that the center of gravity "C" will follow a vertical rectilinear path and find the acceleration "a_c" along this path. Determine also the tensile force "S" in the cord.

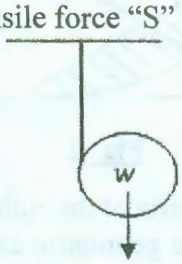

Fig. 5

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15. a) Three spherical balls of mass 2 kg, 6 kg and 12 kg are moving in the same direction with velocities of 12 m/sec, 4m/sec and 2m/sec respectively. If he ball of mass 2 kg impinges with the ball of mass 6 kg, which in turn impinges with the ball of mass 12 kg, prove that the balls of masses 2 kg and 6 kg will be brought to rest by the impacts. Assume the balls to be perfectly elastic.

    b) A ball is dropped from a height h = 1.2m on a smooth floor as shown in knowing that for the first bounce, h = 1 m and D = 0.4m, determine (i) the coefficient of restitution (ii) the height and the range of the second bounce.

16. a) A stone is dropped into a well without initial velocity. Its splash is heard after 3.5 seconds. Another stone is dropped with some initial velocity and its splash is heard after 3 seconds. Determine the initial velocity of the second stone if velocity of sound is 335 m/sec.

    b) A train. Starting from rest is uniformly accelerated during the first 250 m of its run and runs next 750 m at uniform speed. It is then brought to rest in 50 seconds under uniform retardation. If the time taken for the entire journey is 5 minutes, fine the acceleration with which the train started.

17. Answer any ***two*** of the following:

    a) Derive the equation for parallel axis Theorem for MMI.

    b) Two blocks A and B, both are the same weight 'W' are released from rest on a 30° incline, when they are 18 m apart as shown in Fig. 6. The co-efficient of friction under block A is 0.2 while that under block B is 0.4. Compute the time elapsed until the blocks touch. After they touch and move as a unit, what will be the contact force between them?

    c) Two sliders connected by a rigid link 10m long, moves in the frictionless guides shows in Fig. 7. If B starts from rest when it is vertically below A. Determine the velocity of B when $x = 6m. W_A = W_B = 200N, W_C = 100N$(5m)

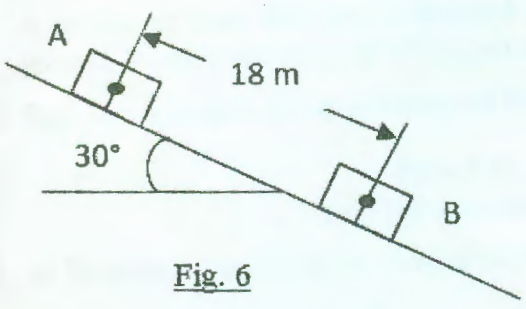

Fig. 6

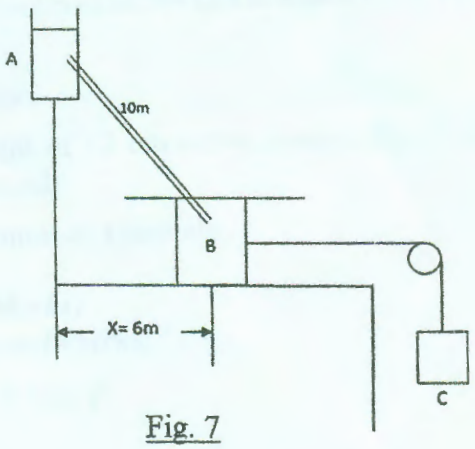

Fig. 7